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MARKETING OILSEEDS AND OILSEED PRODUCTS

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October 1966

MARKETING OILSEEDS AND OILSEED PRODUCTS

By Thomas B. Smith
Agricultural Economist

MARKETING CHANNELS

The physical flow of oilseeds through marketing and processing channels and the distribution of industrial and consumer products manufactured from vegetable oils requires many specialized marketing agencies; costly and complex processing and refining plants; and extensive transportation, storage, and trading facilities. Marketing channels for the various oilbearing crops and the fats and oils derived from them are similar in many respects. However, there are some differences among crops, primarily in the early stages of handling, marketing, and processing. These differences are largely in location and concentration of growing areas, structure of the seeds, and ultimate uses of the oils and byproducts as raw materials for manufacturing industrial and consumer products.

Farmers usually sell most of the soybean crop to country elevators either at harvesttime or following a period of farm or commercial storage (fig. 1). In a few instances, producers sell directly to soybean processors.

A small proportion of the volume of soybeans purchased by country elevators is resold to farmers for seed; however, most is sold to dealers in terminal markets, to domestic processors, or to exporters. Almost all of the beans purchased by terminal market firms are sold to U.S. processors or to exporters.

To aid the orderly marketing of soybeans, highly organized trading facilities have been established in the Boards of Trade in Chicago, Ill., Minneapolis, Minn., and Kansas City, Mo., for bringing sellers and buyer-processors together. The Chicago Board of Trade is the world's largest grain exchange. The Board and the services it provides facilitate the orderly trading and movement of soybeans from farms to country elevators, and then on to firms in the terminal market, and finally to processors and exporters. The Board does not buy or sell, nor does it set prices; it is a marketplace where approximately 1,400 members buy and sell for their own firms, or represent thousands of clients. The Board also provides facilities for the sale and movement of soybean oil and other vegetable oils (16, 23). 1/

There are two types of markets for soybeans in the Chicago Board of Trade--the cash market and the futures market. In the cash market, soybeans are bought and sold regardless of their location and final destination. Buyers in this market are generally processors who buy soybeans in the country or at Chicago and intend to crush them at one of their plants, exporters who buy soybeans to ship abroad on contracts already made or in anticipation of contracts, or owners of terminal (Chicago) elevators buying on their own account.

Sellers in the cash market are producers and country elevators who ship to Chicago and sell before the beans arrive, while they are in transit, or after they have actually arrived in Chicago; and brokers who represent the country processors, country elevators, or other sellers. All soybeans going through the Chicago market are sold by sample. Samples are graded according to stringent Federal Standards by licensed inspectors.

1/ Underscored numbers in parentheses refer to Selected References, p. 191.

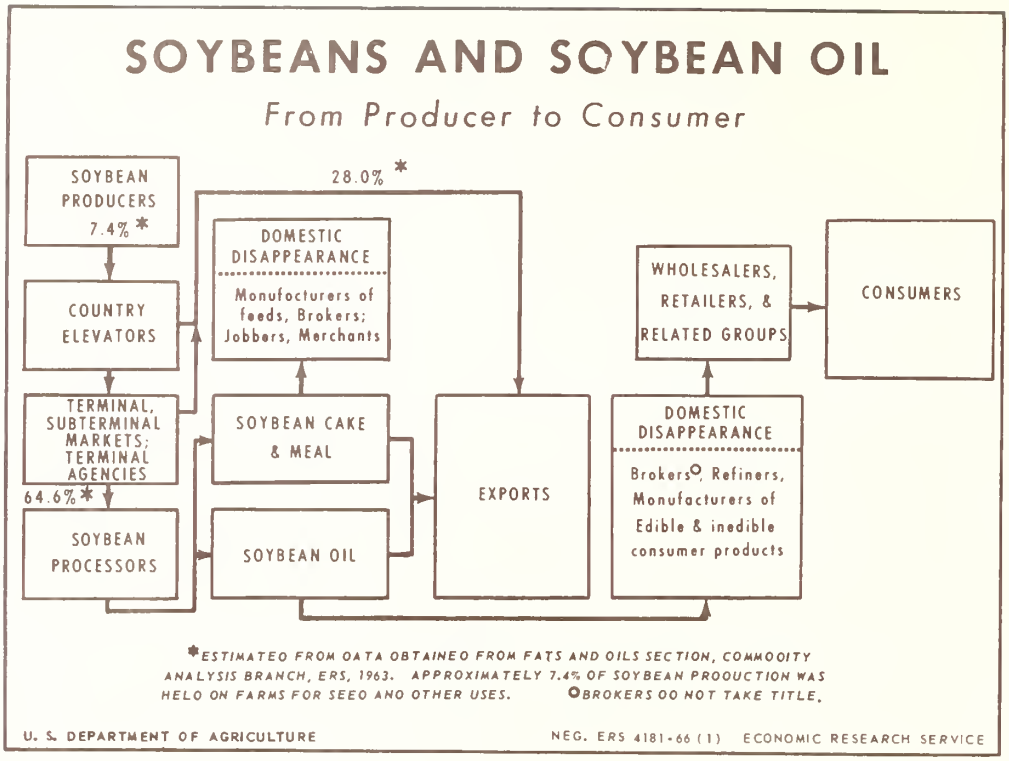
SOYBEANS AND SOYBEAN OIL
From Producer to Consumer
SOYBEAN PRODUCERS 7.4% *
28.0% *
DOMESTIC DISAPPEARANCE
Manufacturers of feeds, Brokers; Jobbers, Merchants
WHOLESALERS, RETAILERS, & RELATED GROUPS
CONSUMERS
COUNTRY ELEVATORS
TERMINAL, SUBTERMINAL MARKETS; TERMINAL AGENCIES
SOYBEAN CAKE & MEAL
EXPORTS
DOMESTIC DISAPPEARANCE
Brokers°, Refiners, Manufacturers of Edible & inedible consumer products
64.6% *
SOYBEAN PROCESSORS
SOYBEAN OIL
*ESTIMATED FROM DATA OBTAINED FROM FATS AND OILS SECTION, COMMODITY ANALYSIS BRANCH, ERS, 1963. APPROXIMATELY 7.4% OF SOYBEAN PRODUCTION WAS HELD ON FARMS FOR SEED AND OTHER USES. °BROKERS DO NOT TAKE TITLE.
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Figure 1

The futures market deals in or handles contracts for future deliveries. There are strict regulations established by the membership, and the exchange is licensed by the U.S. Department of Agriculture as a futures contract market. The Board of Trade specifies the quality of all soybeans to be delivered on a futures contract and it spells out all details of a complete contract.

The flow of cottonseed from the farmer to the oil mill differs from the flow of soybeans, because it is a joint product with the lint and because it is perishable. Most cotton producers sell their cottonseed to ginners or directly to oil mills (fig. 2). Because it is a bulky commodity, and also because considerable care is needed in handling and storing it to preserve quality, cottonseed moves to the mills within a few days after ginning. Mills buy cottonseed on an as-is or a graded basis; a uniform price is paid for all seed delivered on an as-is basis (2, 18).

Since the late thirties, the number of cottonseed processors has declined, but the average size in terms of volume of seeds crushed has increased. These changes have resulted largely from efforts of processors to increase operating efficiency and reduce costs through adopting more efficient processing methods and laborsaving devices. For mills processing cottonseed, the changes have been relatively continuous. For example, in 1939, 447 cottonseed oil mills (29) crushed an average of about 9,000 tons of cottonseed per mill; in 1965, 205 mills 2/ crushed an estimated average of 29,000 tons.

2/ International Green Book of Cottonseed and Other Vegetable Oil Products. The Cotton Gin and Oil Mill Press, Dallas, 1965.

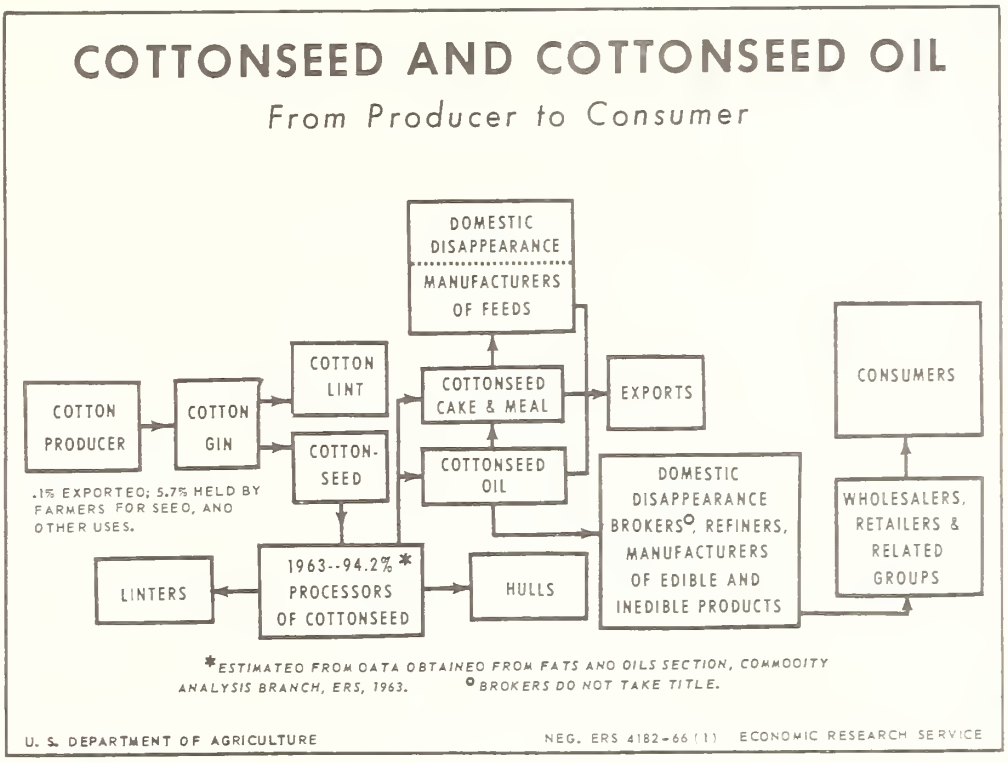
COTTONSEED AND COTTONSEED OIL
From Producer to Consumer
DOMESTIC DISAPPEARANCE
MANUFACTURERS OF FEEDS
COTTON PRODUCER
COTTON GIN
COTTON LINT
COTTON-SEED
COTTONSEED CAKE & MEAL
COTTONSEED OIL
EXPORTS
CONSUMERS
.1% EXPORTED; 5.7% HELD BY FARMERS FOR SEED, AND OTHER USES.
DOMESTIC DISAPPEARANCE BROKERS°, REFINERS, MANUFACTURERS OF EDIBLE AND INEDIBLE PRODUCTS
WHOLESALERS, RETAILERS & RELATED GROUPS
LINTERS
1963--94.2% * PROCESSORS OF COTTONSEED
HULLS
*ESTIMATED FROM DATA OBTAINED FROM FATS AND OILS SECTION, COMMODITY ANALYSIS BRANCH, ERS, 1963.
°BROKERS DO NOT TAKE TITLE.
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Figure 2

The situation has been different for mills processing soybeans, because the soybean industry has grown rapidly since the late thirties, whereas the cottonseed industry has been relatively static. The number of mills processing soybeans increased during the late thirties and early forties, yet after that time, soybean processors, like cottonseed processors, were decreasing in number and increasing in size during most years. There were only 47 mills in 1939 processing an average of about 1,206,000 bushels of soybeans per mill. By 1947, there were 133 mills (29) crushing an average of about 1,214,000 bushels; in 1965, there were 119 mills with an average crush of 4,328,000 bushels. 3/

The marketing channels and the agencies involved in moving some of the minor oilseeds to market are similar to those for soybeans. Flaxseed, for example, is usually moved directly from the farm to country elevators for immediate sale or for storage by producers. Country elevators sell their flaxseed to terminal market firms, which store it, sell and deliver it to oil-extraction plants, or export it (14, 15).

After oilseeds have been processed into oil and meal, the processors sell the oil to refiners or to manufacturers of industrial and consumer products. Since soybean and cottonseed oils are both used primarily in the manufacture of edible products, such as margarine, shortening, salad or cooking oils, and salad dressing, most refined soybean and cottonseed oil moves to the manufacturers of these products. These manufacturers then become the principal agencies for distributing the products to retail stores.

3/ The Soybean Digest--Blue Book Issue. Amer. Soybean Council of America, Hudson, Iowa.

Inedible oils and fats move through the marketing, distribution, and manufacturing agencies to retail stores in a similar manner to that described for edible products. These inedible oils are used for such products as paints, varnishes, soaps, and lubricants, and some are used in livestock and poultry feeds.

STORAGE AND TRANSPORTATION

Transportation has had a significant influence on the development and location of the soybean processing industry. The practice of granting "milling-in-transit" privileges to the soybean processors at specific locations was initiated by railroads when the industry was in its infancy to induce processors to build mills on their lines (25). This privilege has limited the use of trucks for moving soybeans to processing plants. Only 14 percent of the 1963-64 crop was moved by trucks, compared with 64 percent by rail and 22 percent by water. With the mechanical unloading and elevator equipment at most processing plants, soybeans received in boxcars can be handled with less cost than those received in trucks. Soybeans are especially adaptable to bulk handling by machinery. A plant may obtain beans from a distance of 100 miles or more, depending on factors such as the size of crushing operation, density of bean production in the area of the mill's location, and the procurement policy of the plant.

A plant usually provides facilities to store enough soybeans for 80 to 100 days' operation (4). Typical storage facilities consist of round silos arranged in a square around a central well that contains bucket elevators. The silos vary in size with the processing plants' crushing needs.

Rail transportation is relatively unimportant in the movement of cottonseed to the processing plants. Most cottonseed is transported from the cotton gin to the cottonseed processing mills by trucks. The trucks are usually owned by the gins, or the ginner has them under contract, although some are owned by the processing mills. When trucking is done by the gins, the mill pays the ginner for the trucking service.

Cottonseed begins to flow to mills from gins at the start of the cotton ginning season and ceases altogether at the completion of cotton harvesting (2, 12, 21). The marketing season begins with harvesting and ginning, which usually starts in July in Texas and moves northward, eastward, and westward with the advance of the season. Cotton harvesting is usually completed in December unless bad weather delays field activities. Thus, the cottonseed storage requirements for cottonseed oil mills are related to each mill's annual crush.

The storage of large quantities of cottonseed on the farm and at the cotton gin has proved unsatisfactory because the seed deteriorates rapidly. Therefore, cotton ginners truck their seed to the oil mills as it accumulates. Crushing plants are usually equipped with facilities to protect and maintain the quality of the seed and to accommodate the quantity needed for the crushing season (2, 3, 21).

Seed may be bought by the mill "as-is" or by grade. If as-is, the mill offers a uniform price for all seed delivered, purchases being made on the basis of average quality.

On a grade sale, a sample is taken of each load of seed on arrival at the mill, and the samples are sent to an independent laboratory for grade analysis. In buying by grade, the mill offers prices for 100-grade seed, with premiums being paid and discounts deducted for seed grading above or below 100.

The flaxseed grower often faces the problem of insufficient storage because flaxseed competes with soybeans and grains for storage facilities, and the space available for flaxseed storage tends to vary directly with the extent to which flaxseed harvest follows that of other grains. Flaxseed is more expensive to store than some other grains, such as wheat, because of its slippery nature, sensitivity to moisture, high dockage content, relatively low test weight, and high unit value affecting shrinkage and insurance costs. Elevators with cleaning equipment usually clean flaxseed upon receipt and before storage to remove high-moisture weed seeds, thereby reducing the risk of mold growth and heat deterioration (14, 15).

The harvest season for flaxseed usually runs from August through November, and the marketing year from July through June. Flaxseed is handled in the marketing system in much the same way as grain.

Most flaxseed enters the marketing system through the country elevators, and from that point moves into terminal markets for further storage or delivery to more distant terminals, eventually reaching the oil extraction plants primarily through dealers and merchandisers.

The producer usually markets his flaxseed without further processing after harvesting. Once the seed is loaded on the trucks at the farm, it goes directly to country elevator assembly points for immediate sale or storage.

Most of the flaxseed is delivered to country elevators in farmer-owned vehicles; only a small portion of the crop is assembled in elevator-owned trucks. Eighty percent of the flaxseed is produced within 10 miles of the elevators to which it is delivered. The movement of flaxseed from the country elevators to processing plants and other points is primarily by rail (14, 15).

The principal midwestern terminal markets used by country elevators are Minneapolis and Duluth, Minn.; others that are less extensively used are Sioux City, Iowa, and the Canadian terminal of Winnipeg. Minneapolis is the leading market for flaxseed produced in the United States because of its strategic location in relation to the production area, because many of the leading flaxseed processors are located in the Minneapolis area, and because there is more storage space available in that area.

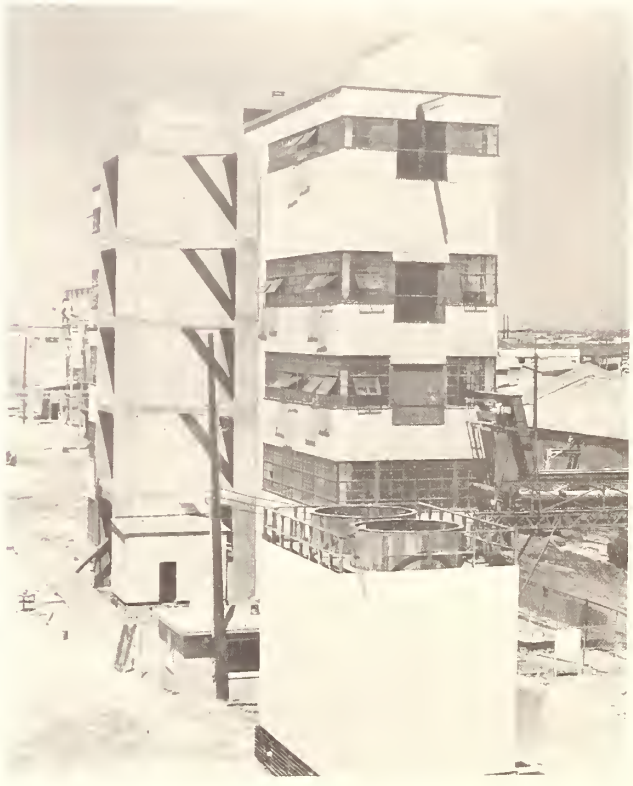
Normally, all grain moving from local elevators to the terminal markets by common carrier is shipped according to uniform class rates which are supplied on a 100-pound basis. Flaxseed is the one exception to the uniform class rate for grain. The charges for flaxseed shipped by rail are 112 percent of the normal grain rates. Truckers levy a charge of 3 cents per bushel for flaxseed above the regular grain rate. The higher rate is charged because of the higher unit value of flaxseed and the additional risk involved.

PROCESSING METHODS AND COSTS

There is considerable vertical integration of processing of oilseeds, refining of oil, and manufacture of end products. As an example, a major company may own and operate plants at all three levels of processing; or a company may both refine and manufacture products, but not crush oilseeds (9). A substantial proportion of the refined cottonseed and soybean oil is produced by a few large companies. More than three-fourths of the oil is produced in shortening and cooking oil establishments, and of this, more than half is produced by four large companies (9).

Oil-storage tanks at an oilseed processing plant.

Exterior of a solvent extraction building.



In general, soybeans and flaxseed move through cleaning directly to the crushing, cooking, and extraction stages of processing. Cottonseed requires several additional steps. It must be delinted, and the hulls separated and removed from the meats before crushing. Also, the hulls and linters require processing to transform them into useful products.

After cleaning and other preparation, oil is extracted from the oilseeds by mechanical means, solvent methods, or a combination of the two. Screw presses and hydraulic presses are the major mechanical methods for extracting oil. However, there are some mechanical operations in direct solvent extracting. The relatively newer solvent methods are generally more efficient than the mechanical methods. In terms of both oil yield and labor requirements, the hydraulic method is the least efficient of the mechanical methods of oil extraction.

Both mechanical and solvent methods are used for extracting soybean oil. However, the direct solvent method predominates. As a general rule, beans are processed by prepress solvent methods only when the profit is sufficient to cover added expense. Currently, more than 95 percent of the soybeans are processed in plants using solvent extraction methods. Beginning in the middle fifties, the number of processing plants has decreased and the average size of plants has increased. With the more efficient solvent extraction method, oil yield per bushel of beans has tended to increase and processing cost to decrease (5, 11).

Analyses of soybean-oil extraction methods indicate that the larger the mill, the greater the advantage of shifting from the screw press to the solvent method of extraction. The investment requirements per bushel of beans decline more rapidly for the solvent process than for the screw-press process (3, 4).

For many years, oil was extracted from cottonseed by hydraulic presses only. However, since the midforties there has been a gradual shift to the more efficient screw-press and solvent methods of extraction. In the early fifties, more than one-half of the cottonseed was processed by the hydraulic method, approximately one-third by the screw-press method, and the remainder by solvent methods. Currently, more than one-half of the seed is processed by the screw-press method, about one-third by solvent methods, and the remainder by hydraulic presses. Also, the average size of plant has more than tripled, the number of plants has decreased more than 50 percent, and oil yields per ton of seed have increased (3, 4, 15, 24). Studies of processing costs indicate that, as a general rule, when the annual volume of cottonseed processed increases, processing costs decrease, and that the solvent methods of oil extraction result in lower cost per ton of seed processed and higher oil yields (3, 4).

Labor is one of the major items of cost in processing cottonseed, and wage rates continue to move upward. Labor requirements per ton of seed processed in the 1961-62 season were substantially lower for mills using the solvent extraction processes than for mills using the hydraulic-press method. However, screw-press mills spanned the extremes of labor requirements for all presses, with some using nearly as much labor per ton as the hydraulic operations and others using less than the solvent mills. Thus, it appears that many cottonseed oil mills could reduce their costs per ton of seed processed by more efficient utilization of labor (24).

Most flaxseed is processed by solvent methods and the remainder with screw presses. During the past decade, the number of plants processing flaxseed decreased and the average annual crush increased. Currently, there are about 50 percent fewer mills processing flaxseed than there was 10 to 15 years ago, but the average annual crush per mill has doubled. The greatest number of mills and the greatest volume of crush are concentrated in Minnesota. Some of the Minnesota plants may spend from 25 to 50 percent of their operating time crushing soybeans; some plants have utilized as much as 25 percent of their time processing flaxseed screenings. Most mills processing flaxseed operate about 11 to 12 months a year (16, 17).

VALUE OF PRODUCTS AND MARKETING COSTS

During the 1964 crop year, an average bushel of soybeans yielded approximately 11 pounds of oil worth about $1.23 at the processing level and about 48 pounds of meal worth $1.61. The combined value of the two products was $2.84 and the average farm value of a bushel of soybeans was $2.66. This provided a price spread of 18 cents a bushel to cover marketing and processing costs and operating profits.

In recent years, soybean meal has been accounting for an increasingly larger share of the total value of soybean products. The strong demand for soybean meal has been associated with the rising world demand for a cheap source of high-quality protein for expanding livestock industries and for direct human consumption.

In 1964, cottonseed yielded, on the average, about 337 pounds of oil valued in the market at $38.76, 948 pounds of meal valued at $28.07, 458 pounds of hulls valued at $2.48, and 176 pounds of linters valued at $6.16--a total of $76.38. The average farm value of a ton of seed was $47.10. Hence, the price spread to cover marketing and processing costs and operating profits was $29.28.

Oil and meal are the most valuable products of cottonseed. The seed was originally crushed primarily for the oil, but since the early forties meal has become increasingly important relative to oil because of the increasing world demand for meal.

During the 1962 crop year, an average bushel of flaxseed yielded 20.4 pounds of oil valued at $2.65, and 36.9 pounds of meal valued at $1.25. The value of both products combined was $3.90, compared with the average farm value of $2.83 per bushel. This leaves a spread of $1.07 to cover marketing and processing costs. The shift since 1939 in the value of oil and meal produced from flaxseed has not been as pronounced as for cottonseed.

SUPPLY AND PRODUCTION OF FATS AND OILS

United States

The total U.S. supply of fats and oils increased from about 12 billion pounds in 1939 to 25 billion pounds in 1965 (fig. 3). Annual production, imports, and stocks on hand are the major components of the total yearly supply.

Production of fats and oils in the United States increased from almost 8 billion pounds in 1939 to 20 billion pounds in 1965. Domestic production accounted for about two-thirds of the total supply in 1929, compared with more than four-fifths in 1965.

There has been a relatively small and stable carryover from year to year, amounting to about 15 to 20 percent of annual production in the years since 1939. During this period, the United States changed from a net importer to a net exporter of fats and oils. In 1939, we imported about half our oil requirements; now we export about 20 percent of our production.

In terms of both quantity and value of production, animal sources were more important than oilbearing crops before World War II. In 1939, animal sources contributed about 64 percent of total production, and oilbearing crops about 36 percent. In that year, the value of animal fats and oils totaled about $780 million, and vegetable fats and oils, about $260 million. The proportion of the volume accounted for by animal sources declined to 58 percent in 1947, to 54 percent in 1953, and to about 47 percent in the midsixties. Although, in terms of quantity, oilbearing crops became the major source of U.S. supply during the late fifties and early sixties, animal fats remained the most valuable due in part to the relatively high unit value of butter in relation to other fats and oils.

Butter, lard, and inedible tallow and grease have been the most important of the animal fats and oils for the past 25 years. However, the relative importance

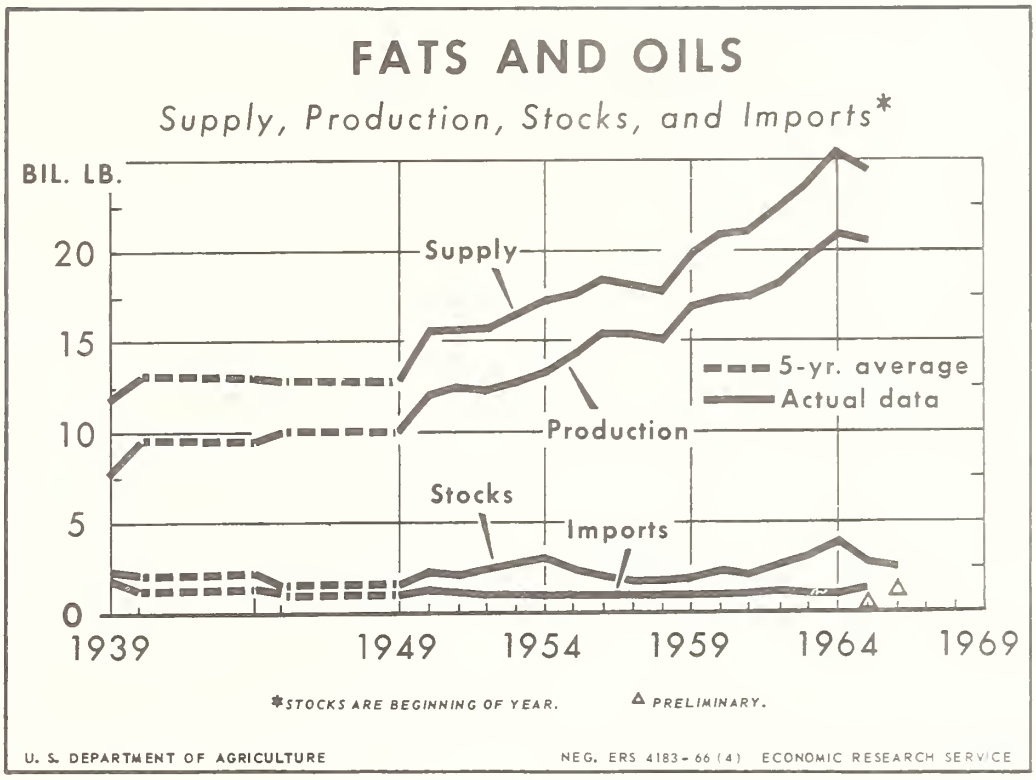


Figure 3

of these three products has changed appreciably during this period. From 1939 to 1965, the annual production of butter declined from 2.2 billion to 1.4 billion pounds. The production of lard remained fairly stable, ranging from 2.0 to 2.1 billion pounds, while production of inedible tallow and grease increased sharply--from 1.1 billion to 4.4 billion pounds. The value of all three products increased during this period. Butter remains the largest contributor to the total value of animal fats and oils.

The decline in quantity of butter produced was associated with the rapid expansion in use of vegetable oils following removal of Federal taxes on margarine in 1950. The rise in inedible tallow and grease accompanied the great expansion in beef production and consumption (10, 26).

Similar changes have occurred for the major oilbearing crops. Quantity of oil produced from soybeans has increased much more rapidly than quantity produced from cottonseed since 1939 (fig. 4). Value of production for both of these oilseeds has increased appreciably during this period. However, the proportionate increase in value was much greater for soybean oil than for cottonseed oil.

Soybeans were a relatively minor oilseed crop before World War II. Less than 5 million bushels a year were produced in the early twenties; in 1965, 852 million bushels were produced (fig. 5). The value of the soybean crop has exceeded $1 billion annually since the midfifties.

The strong demand for all fats and oils during World War II, accompanied by the corn, wheat, and feed-grain programs, greatly stimulated soybean production. Acres harvested increased from 4.3 million in 1939 to 28.6 million in 1963 and 34.7 million in 1965. Research is under way to develop new high-yielding varieties

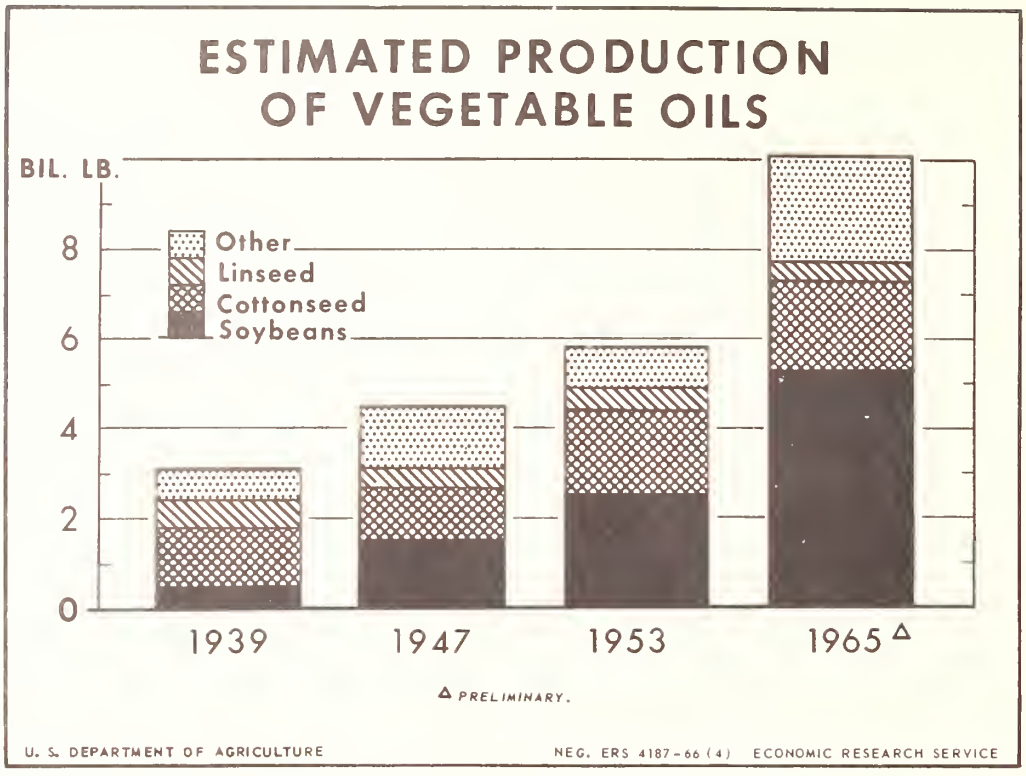


Figure 4

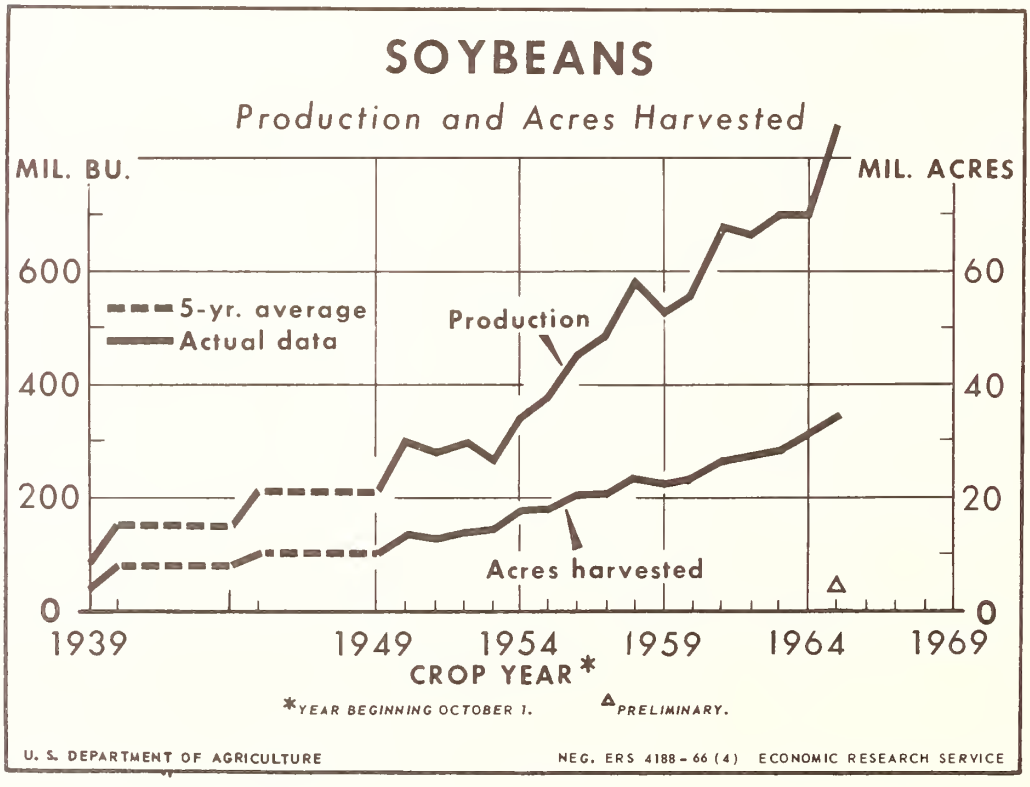


Figure 5

of soybeans that will be adaptable to crop rotation and mechanized production and harvesting methods. This would make possible a breakthrough in soybean production, since over the past 30 or more years there has been little improvement in soybean yields. Increased production has been due primarily to expanded acreage (8, 20).

Most soybean production is concentrated in the Corn Belt States of Ohio, Indiana, Illinois, Iowa, and Missouri; the Lake States of Michigan, Wisconsin, and Minnesota; and the Mississippi Delta States of Mississippi, Tennessee, Louisiana, and Arkansas.

Cotton has been grown for its fiber for many centuries, but until the middle 1800's, cottonseed was considered almost useless. Since the introduction of the first cottonseed crushing mill, it has become one of the most important sources of edible vegetable oil in the United States (26). Production of cottonseed has fluctuated during the past three decades, reflecting the influence of the cotton acreage allotment programs (fig. 6). Since 1933, Government programs have been a major factor in determining the size of the cotton crop, and hence the quantity of cottonseed produced.

Since 1939, flaxseed production has varied widely, with a gradual decline since 1948 (fig. 7). Variations in production were caused by year-to-year changes in acreage and price relationships, varying yields per acre, disease, and adverse weather. Acres of flaxseed harvested varied from 2.2 million acres to 5.7 million, and yields per acre varied from 5 to 12 bushels. Flaxseed is grown primarily in Minnesota, South Dakota, and North Dakota. It is considered to be a high-risk crop and does not occupy a major position in cropping systems.

Safflower production first reached commercial significance in 1949 when 16 million pounds of seed were produced on 40,000 acres. Since then, both acreage and production have increased. Safflower is grown primarily in California; however, it can be grown in the Great Plains, the Pacific Northwest between the Cascade and Rocky Mountains, and in the Southwest (11).

Some oilbearing crops are produced primarily for food and are priced out of the oil market. For example, olives are grown in California primarily for canning, and only small quantities of olive oil are produced in the United States from non-marketable olives, because of the higher value of olives for food.

Sesame seed and oil may also be classed as specialty items. In the United States, almost all sesame is used as the whole seed for food. Sesame can be grown throughout the Southern States, but currently the heaviest concentration is around Paris, Tex. However, production has been limited primarily because the seed ripens unevenly and tends to shatter when ripe. In the early sixties, approximately 15,000 acres a year were harvested, producing about 10.0 million pounds of sesame seed. Imports have exceeded production in all years since the early fifties. From about 11 to 25 million pounds of sesame seed have been imported annually since 1950, primarily from Sudan, the leading exporting country.

Like cottonseed, some of the minor oils are also byproducts of major U.S. crops, and production is limited almost entirely by the economic factors affecting the production of the crops for their primary uses. For example, corn oil is produced from corn germ, a byproduct of the wet and dry milling industries. Although there is a strong demand for corn oil, the supply is limited because it is a byproduct. The annual production of corn oil increased from 151 million pounds in 1939 to 446 million pounds in 1965.

Domestic production of castorbeans was encouraged through special programs in World Wars I and II and the Korean War. In 1951, the U.S. Department of Agri-

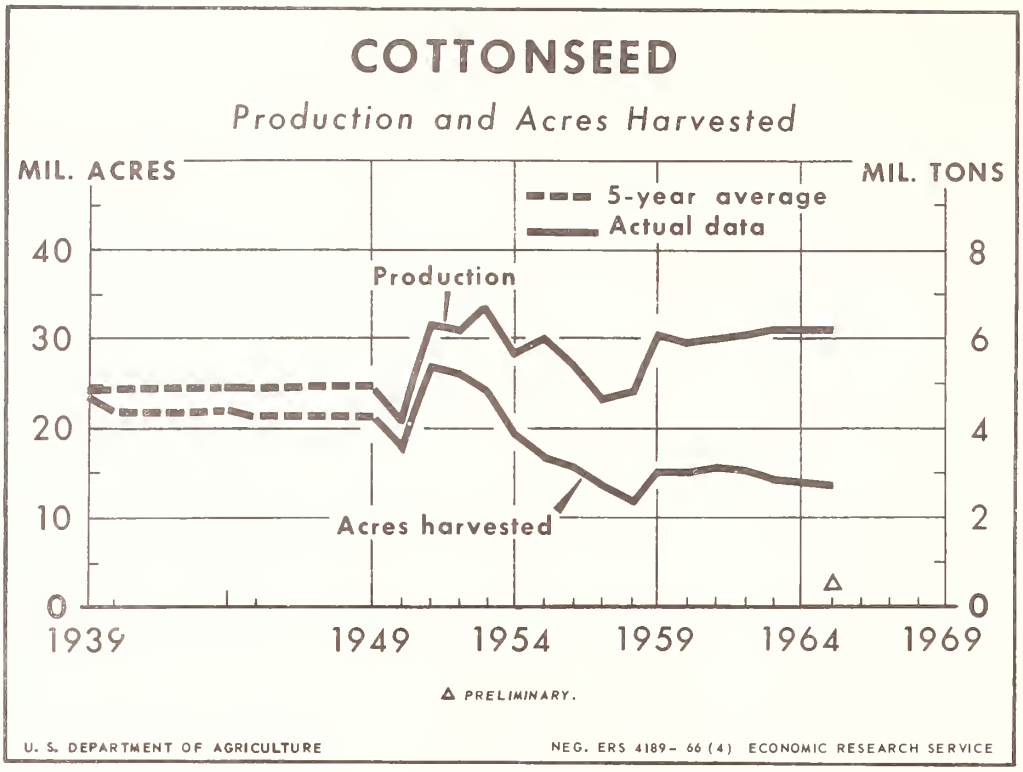


Figure 6

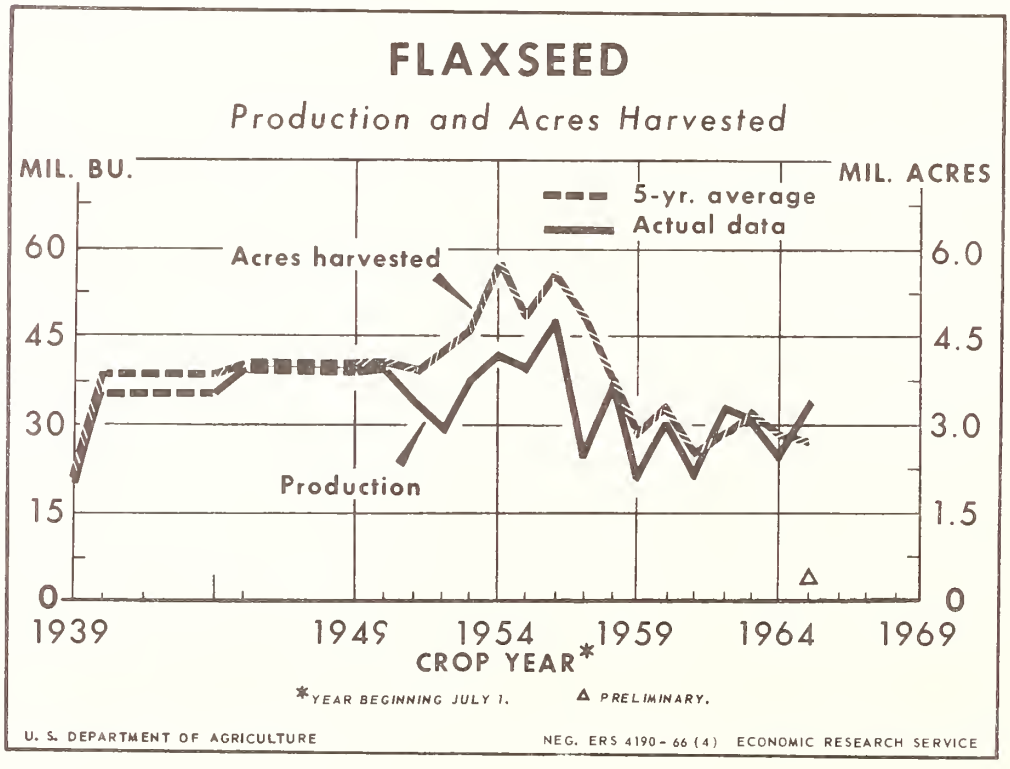


Figure 7

culture initiated a castorbean production and procurement program (7, 13). After 1954, production was placed on a competitive basis. Production has ranged from a low of 21 million pounds in 1951 to 64 million pounds in 1963. Since 1961, farmers have been permitted to plant castorbeans on acreage diverted from feed grains and wheat. During 1940-51, from 226 to 394 million pounds of castorbeans were imported each year. Since 1951, Brazil, the major supplier of beans to the United States, has encouraged the crushing of beans and the export of oil rather than beans. Thus U.S. imports of beans declined sharply to only 2 million pounds in the early and middle sixties.

The tung industry is also fairly new in the United States. Experimentation with the growth of tung trees in the United States dates back to 1905, but it was 1929 before the first tung-oil mill began operation, and 1940 before tung-nut production assumed commercial significance (1, 29). Since 1939, annual production has fluctuated greatly. Weather is one of the primary factors affecting production. Although tung is grown in the warm Gulf Coast area, the fruit is very frequently damaged by frost when the orchards are in bloom and the fruit is setting. Tung-oil production was about 3 million pounds in 1939, and 36.8 million pounds in 1964, but dropped to 12 million pounds in 1965.

In addition to these vegetable sources, tall oil, a byproduct of the sulfite paper industry, contributes to the total U.S. supply of fats and oils. As it is a secondary product, the annual supply of tall oil is dependent on the output of sulfite paper. It was first introduced commercially in 1930, and production increased steadily, to 34 million pounds in 1940, and 1,050 million pounds in 1964.

Since World War II, production of fats and oils has expanded at about the same rate in foreign countries as in the United States. From 1945 to 1965, total world production increased from about 34 billion to 73 billion pounds. For the same period, U.S. production climbed from about 9 billion to 20 billion pounds, accounting for about 26 percent of world production in 1945, and 28 percent in 1965.

Approximately two-fifths of the total world production of fats and oils is now derived from animal fats and marine oils, compared with nearly two-thirds in the late thirties. These sources contributed slightly more than 20 billion pounds in the thirties and about 27 billion in 1965. Edible vegetable oils are becoming increasingly important as a world source of fats and oils. Production of these oils increased from about 16 billion pounds in 1935-39 to almost 33 billion in 1965.

UTILIZATION AND CONSUMPTION OF FATS AND OILS

Domestic consumption of fats and oils increased from 9.2 billion pounds in 1939 to 14.5 billion pounds in 1965 (fig. 8). Domestic consumption alone accounted for more than 90 percent of total disappearance in 1939, but only 60 percent in 1965.

Approximately 1 billion pounds of fats and oils were exported annually from 1939 to 1949. Beginning in 1950, yearly exports showed some increased activity and there was a striking increase in 1954, resulting from the P.L. 480 program. 4/ By 1965, exports reached 7.5 billion pounds. Exports are expected to continue to be a strong outlet for domestic fats and oils. Countries of Western Europe, Canada, Colombia, Iran, Pakistan, Turkey, Morocco, Israel, and Tunisia are the largest export markets

4/ P. L. 480 is the Agricultural Trade Development and Assistance Act of 1954.

for U.S. vegetable oils, primarily soybean and cottonseed oil. Exports to these countries are expected to remain large and possibly increase in the future because most of the countries are not naturally well adapted for production of oilseed crops (5).

End-of-year stocks fluctuate somewhat from year to year. They averaged close to 1 billion pounds or higher from 1939 to 1949, then increased to 3 billion pounds in 1953. Stocks carried over then dropped to about 2 billion pounds annually through 1960, but increased to 2.7 billion pounds by the end of 1965.

Domestic Food and Nonfood Uses

Since 1939, about two-thirds of the domestic consumption of fats and oils has been for food uses, and one-third for nonfood uses. The total quantity utilized by the food industries increased from 6.1 to 8.8 billion pounds from 1939 to 1963, and in 1965 reached 9.5 billion pounds. Volume going into industrial products increased from 3.1 billion pounds in 1939 to 4.8 billion pounds in 1963 and to 5.0 billion pounds in 1965 (figs. 9 and 10).

Soap-manufacturing industries accounted for more than one-half of the total nonfood use of fats and oils from 1939 to 1949. About 2 billion pounds annually were utilized in soap during this 11-year period. Since the early fifties, the total volume of fats used in soap has declined by more than 50 percent, to approximately 0.7 billion pounds in 1965. Manufacturers of drying-oil products use about 0.8 to 1.1 billion pounds of fats and oils annually. Drying oil and soap combined accounted for 84 percent of the industrial utilization of fats and oils in 1939, whereas in 1965 they accounted for only 33 percent. Other industrial products, such as fatty acids, animal feeds, and lubricants and similar oils have accounted for half or more of the nonfood use since the late fifties.

The use of fats and oils in drying-oil products has declined because of increased use of synthetic resins. The use of fats and oils in all protective coatings decreased between 1939 and 1965, while the use of plastics increased from 0.3 pound to 1.3 pounds per gallon. Use of synthetics in lieu of fats and oils increased because of relative price advantages of synthetics over fats and oils, and improved processing techniques which turn out a highly acceptable and durable synthetic product. As a result, per capita consumption of fats and oils in drying-oil products dropped from 6.3 pounds to 4.6 pounds.

From 1939 through 1945, over half of the fats and oils used in foods was accounted for by butter and lard. Since the late fifties, these two products have accounted for less than one-third of the total fats and oils utilized in foods. In 1939, 1.8 billion pounds of butter and 1.7 billion pounds of lard were consumed in foods; by 1965 the volume had declined to about 1.0 billion pounds of butter and 1.2 billion pounds of lard. In contrast, the quantities of fats and oils used in shortening during this period increased from 1.4 to 2.7 billion pounds, and the quantity used in margarine declined from 0.2 to 1.5 billion pounds. Quantities used in other food products such as salad and cooking oils also greatly increased, from 0.9 to 2.8 billion pounds annually.

Manufacturers of shortening and margarine depend primarily on vegetable oils as their major raw material. There has been a pronounced shift in the source of these oils since the late thirties. In 1939, cottonseed oil accounted for 64 percent of the total fats and oils used in shortening; by 1965 the proportion had declined to 14 percent. In contrast, soybean oil accounted for only about 15 percent of the oils used in shortening in the late thirties; the percentage increased to 52 percent in 1965. Lard and tallow

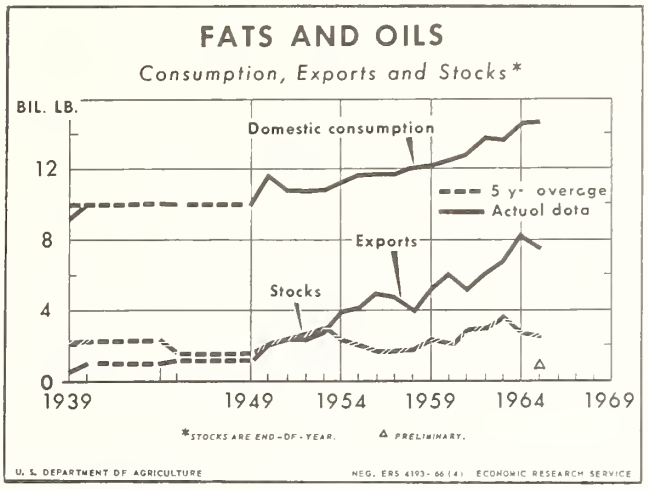


Figure 8

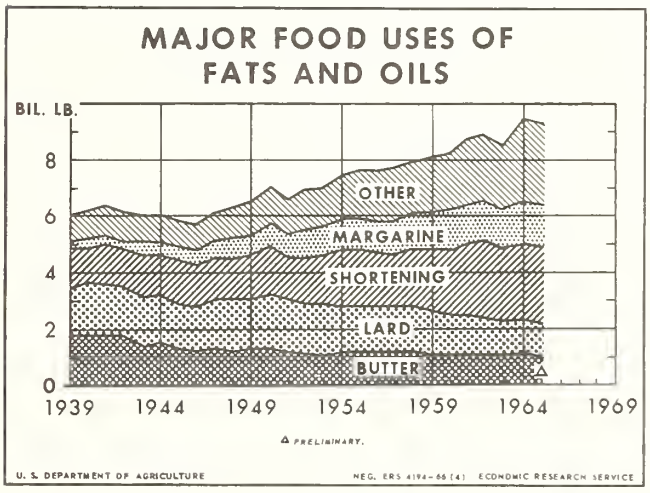


Figure 9

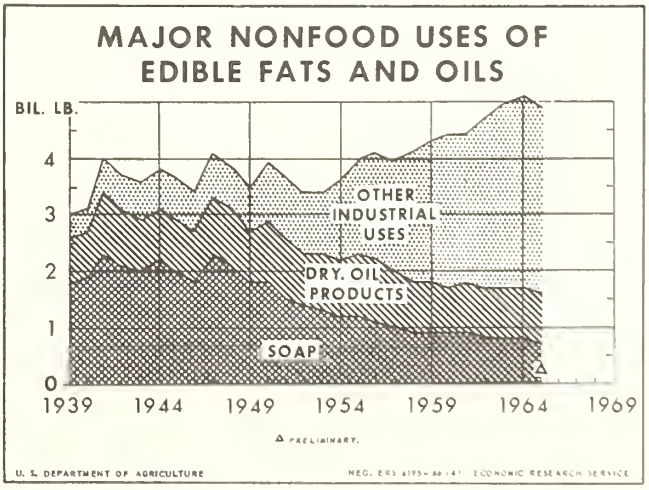


Figure 10

were minor sources of fat for the shortening industry up to the early fifties, accounting for less than 10 percent of total raw material. From 1950 to 1956, lard and tallow as a proportion of total fats and oils used in shortening increased from 11 to 32 percent. Since 1956, the percentage has continued to increase, although more slowly. In 1965, it was 31 percent. Since the early sixties, lard and tallow, and soybean oil, have accounted for more than four-fifths of the fats and oils used in shortening.

In the manufacturing of margarine a similar shift in the use of fats and oils occurred. In 1939, less than 30 percent of the oils used in this product was derived from soybeans. By the late fifties, soybean oil accounted for about 85 percent, then gradually declined to 72 percent in 1965. Use of soybean oil in the manufacture of margarine increased primarily with the decrease in use of cottonseed oil. In the early forties, about 45 percent of the oil used in this product was cottonseed oil, and during the late forties, about 55 percent. However, since 1950, the proportion has declined; it was only 7 percent in 1965. In addition to the pronounced shift from cottonseed oil to soybean oil during the past 15 years, there has been a fairly significant increase in the use of other fats and oils since the late fifties. In 1958, other fats and oils accounted for only 4 percent of the total used in margarine, but by 1965, they accounted for 27 percent.

Changes in Per Capita Consumption

Although total supply of fats and oils has increased sharply in the past 20 to 25 years, per capita consumption has remained fairly constant at about 70 pounds--about 45 pounds of edible fats and oils, and 25 pounds of inedible fats and oils.

The per capita consumption of edible vegetable oils has gradually increased (fig. 11). In contrast, per capita consumption of edible animal fats and oils has declined.

With respect to specific food products, per capita consumption of margarine (fat content) increased from less than 2 pounds in 1939 to about 7.5 pounds in the sixties. For butter (fat content), per capita consumption declined from 14 pounds to 6.5 pounds by 1965. Similar but less pronounced trends have occurred for shortening and lard. Per capita consumption of shortening increased from around 10 pounds in the early forties to about 14 pounds by the midsixties, while per capita consumption of lard (direct use) dropped from about 13 to 6 pounds during this period. For both cooking fats combined, consumption declined from 23.4 pounds per person in 1939 to 20.3 in 1965. The consumption of vegetable oils used in other edible products, mainly in cooking and salad oils, increased from 7.2 pounds in 1939 to 14.2 pounds in 1965.

The increased use of margarine, shortening, and other products containing vegetable oils can be attributed to improved processing techniques, such as hydrogenation of vegetable oil which began just before World War II; the feeling of many consumers that the polyunsaturated fats in vegetable oils are a health advantage; the close resemblance of margarine to butter in color, flavor, and appearance; removal of the Federal tax on margarine in 1950; and the relative price advantage of margarine over butter.

Utilization of Oilseeds

From 90 to 100 percent of each year's total supply of soybeans is utilized domestically or exported, and only a small proportion is carried over to the following year.

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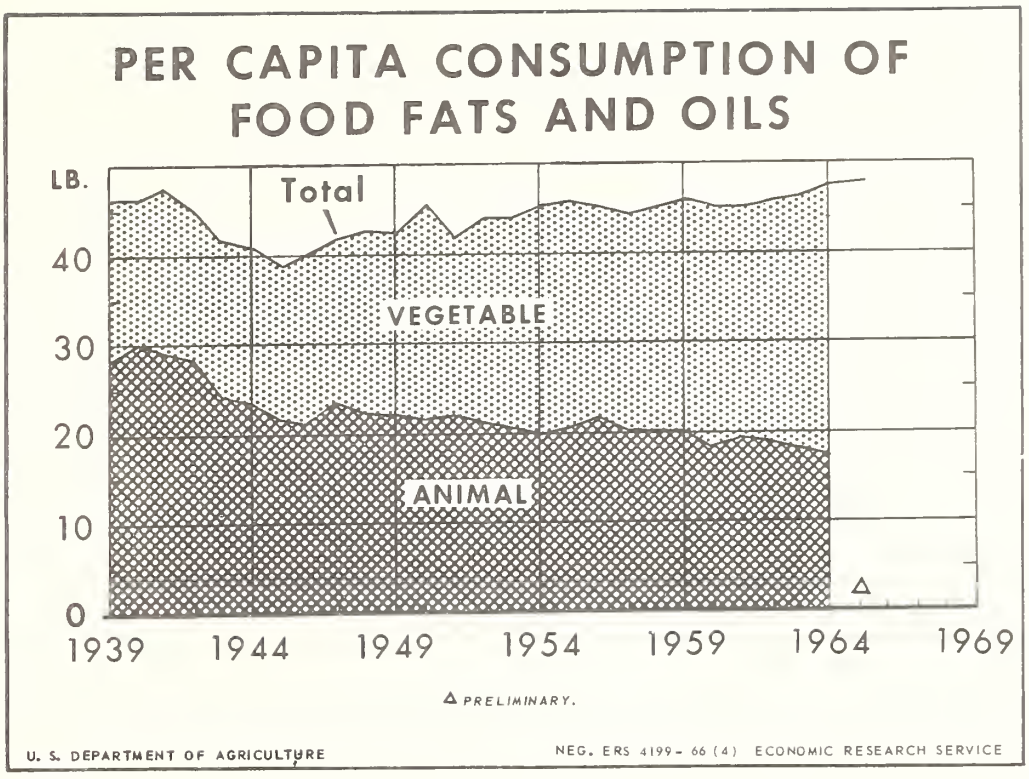

Figure 11

Soybean processors are the primary users of soybeans. They crushed 70 percent or more of the total annual volumes of soybeans used since 1950. The volume of beans crushed has shown slight drops and rises since the early fifties, when more beans began moving into the export market. Consumption of beans for feed and seed has declined from prewar years. During 1950-65, these uses represented 8 percent or less of the total beans used, whereas in 1939 they represented 18 percent.

The volume of soybean oil used in foods in 1965 was more than 10 times the volume used in 1939. Over two-thirds of the total disposition of soybean oil was for domestic use in the production of food products each year during 1939-65 (fig. 12). Shortening and margarine manufacturers were the heaviest consumers of soybean oil, together accounting for about 56 percent of the domestic consumption in 1965. Manufacturers of other food products used about 35 percent, and the remaining 9 percent went into nonfood uses.

Increased use of soybean oil in the production of margarine and shortening has been associated with expanded production of these commodities. The quantity of soybean oil used in margarine increased from 71 million pounds in 1939 to 1,112 million pounds in 1965. Soybean oil accounted for 72 percent of all fats and oils used in margarine in 1965. Soybean oil used in shortening increased from 0.2 billion pounds in 1939 to 1.4 billion pounds in 1965; it accounted for 53 percent of all oils used in shortening in 1965.

Cottonseed, a valuable raw material for the oil industry, also has many byproduct uses after crushing (fig. 13). During 1939-65, 83 to 91 percent of the domestic seed supply was crushed, 4 to 10 percent was used for seed, and the remainder was held in stocks or exported.

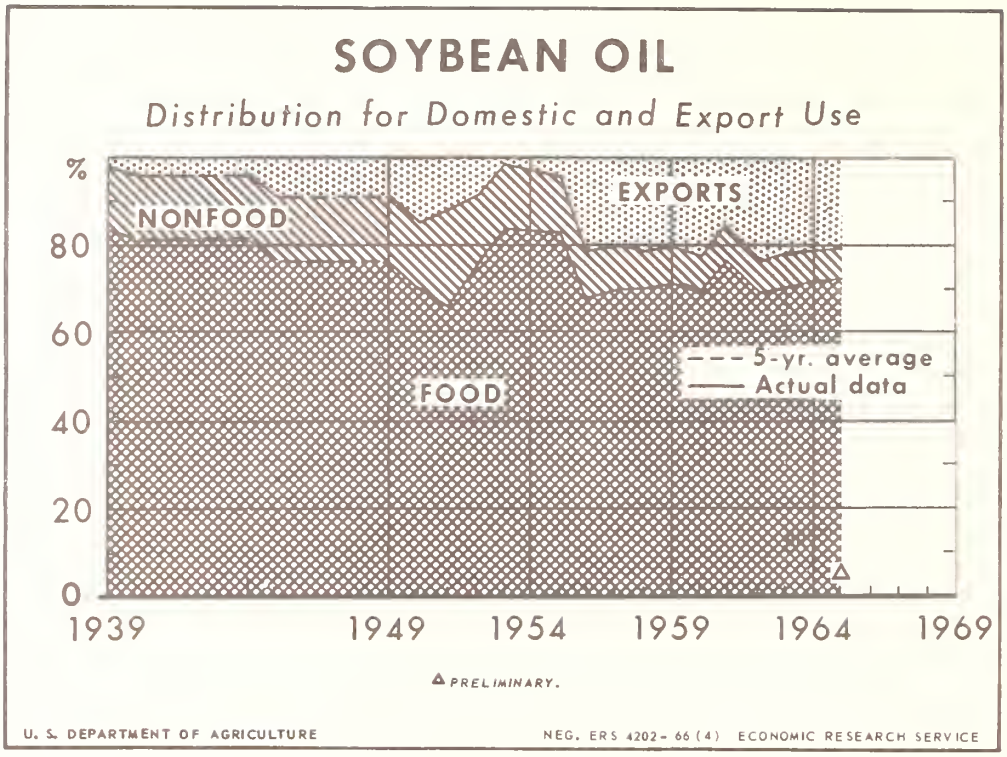

Figure 12

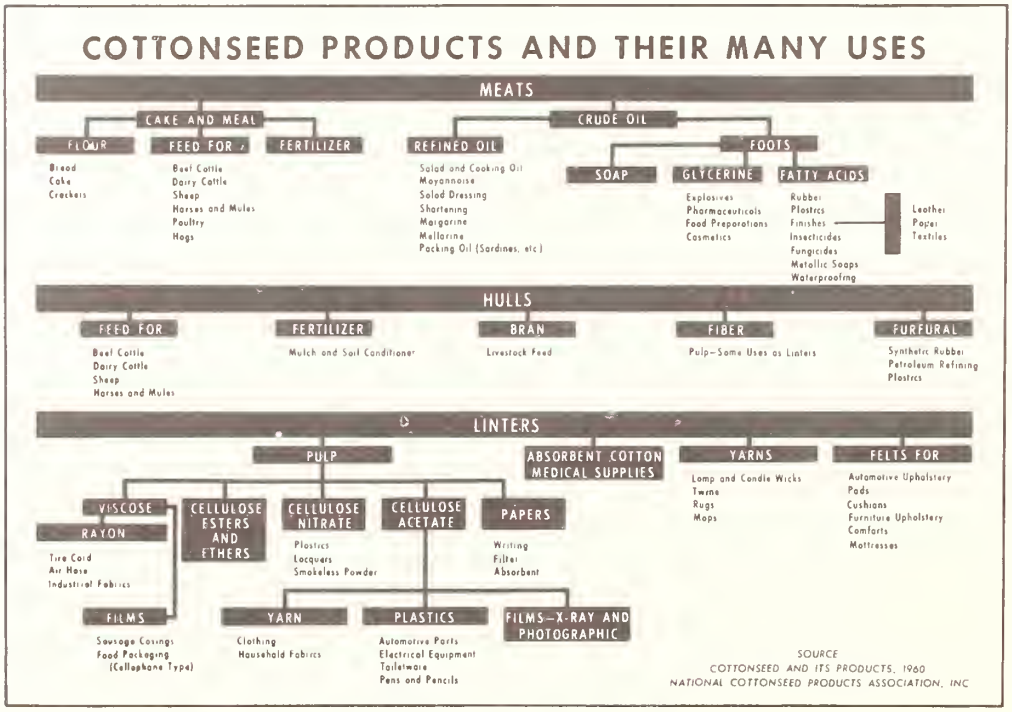

Figure 13

Through the years, cottonseed oil has been used primarily in food products. Although much is still used, the proportion has declined since 1939. In recent years, lower-priced soybean oil has displaced considerable amounts of cottonseed oil in the production of margarine, shortening, and salad oils. This has made larger quantities of cottonseed oil available for exporting. During the early forties, 90 percent or more of the disposition was for domestic use in food products; by the sixties, the proportion was about 70 percent (fig. 14).

The proportion of cottonseed oil used in the production of margarine dropped from more than one-fourth of the domestic use in 1950 to about 7 percent in 1965. During this same period the quantity of cottonseed oil used in the production of other food products such as mayonnaise, salad dressing, and cooking oils consistently increased. In 1950, other food products accounted for 29 percent of the domestic consumption, compared with 60 percent in 1965.

Most flaxseed is crushed for oil, and for cake and meal. During 1939-65, from 63 to 92 percent of the annual supply of flaxseed was used, and the remainder was held in stocks. Of the quantity used, from 70 to 97 percent was crushed, from 1 to 25 percent was exported, and from 6 to 11 percent was used for seed. The quantity crushed since 1956 shows a decline from earlier postwar years, reflecting primarily the decreasing demand for linseed oil in drying-oil products. There was no pronounced trend in exports of flaxseed, although the volume moving to foreign outlets has been stronger since 1954 than in earlier postwar years. This increase resulted primarily from the movement of stocks acquired by the Commodity Credit Corporation under price-support programs.

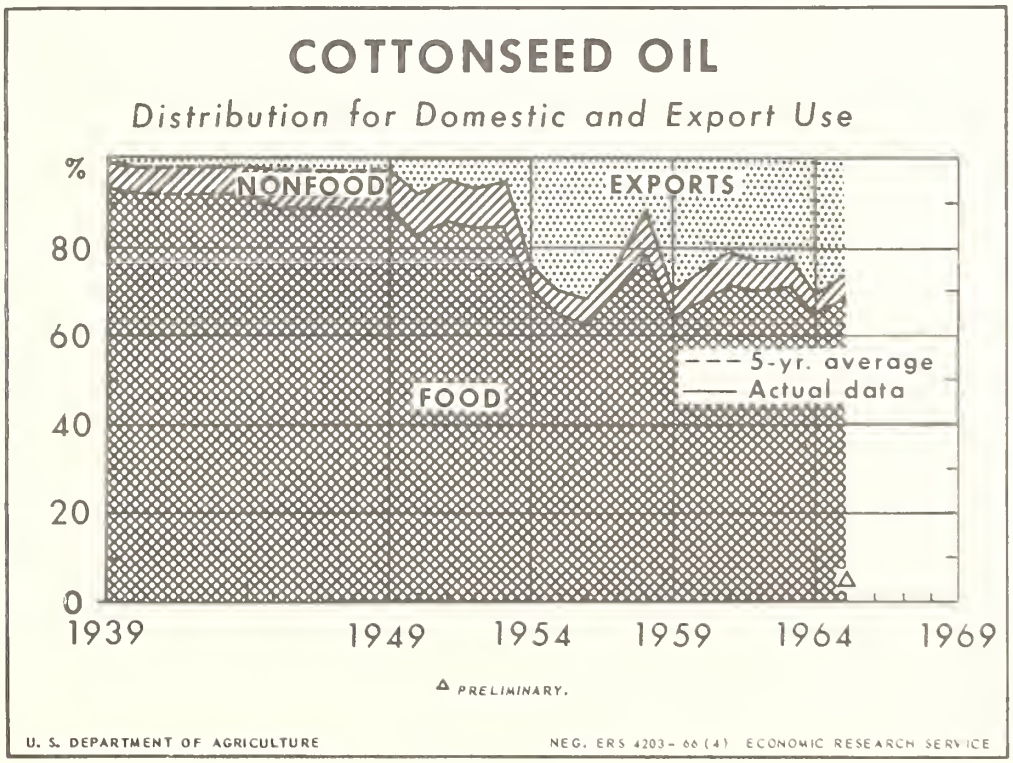

Figure 14

Linseed oil is produced mainly for the domestic market, and it is used almost entirely for industrial products. For many years, 95 percent or more of the linseed oil consumed was used in the manufacture of drying-oil products. The sharp drop in production of linseed oil was due mainly to the increasing use of synthetic resins in drying oils.

In the United States, safflower seed is crushed and most of the oil produced is used either as a drying or as an edible oil; the recent trend has been toward more use in foods. Sesame seed is used both as food and as an oilseed crop; most is used as the whole seed for eating purposes. Although olives are produced and used primarily for bottling and canning, the inferior grades are crushed for oil. All corn germ is used for edible oil. Both tung and castor oils are used primarily for industrial purposes.

The export market is becoming increasingly important for soybeans. In 1965, 250 million bushels, about 30 percent of the total disposition, were exported. In comparison, 11 million bushels, 12 percent of total disposition, were exported in 1939.

The volume of soybean oil exports has varied considerably since 1939. From 1939 through 1956, the export market was erratic, with the annual export volume ranging from a low of 12 million to a high of 679 million pounds. Since 1956 the export market has continued strong. This has been chiefly due to expanded Government-financed programs, mainly the P.L. 480 program.

In recent years, the export market has played an important part in the disposition of cottonseed oil. One-fifth or more of the total disposition since 1954 has moved into export channels. In 1939-53, only relatively small quantities were exported.

Exports of linseed oil were light during 1950-52, accounting for less than 2 percent of the supply. However, from 1953 through 1957 exports accounted for 8 to 38 percent of the annual supply. Following this increase, which was due primarily to the movement of linseed oil from CCC stocks, exports in 1965 dropped to 7 percent of total supply.

PROBLEMS AND PROSPECTS

The rapid increase since World War II in the domestic production of fats and oils has been due primarily to the increasing production of soybean oil and inedible tallow and grease. Production of these fats is currently at a record high, and is expected to continue its increase during the next few years.

During the postwar period, the production of food fats has increased more rapidly than domestic requirements, and considerable quantities of food fats have been exported, particularly soybean oil and cottonseed oil. Exports of soybean and cottonseed oil are expected to continue strong during the next few years as the worldwide demand for fats and oils continues to rise with the rise in population. In many countries, per capita consumption of fats and oils can be expected to rise with rising consumer incomes (5).

The P.L. 480 program has given strong impetus to the flow of fats and oils through the export market in recent years. The proposed Food for Freedom program would further encourage this flow.

Domestic consumption of food fats per person will probably continue fairly stable during the next few years. However, shifts can be expected from one type of fat to another. Soybean oil now takes the greatest share of the market for edible vegetable oils, but competing oils such as cottonseed, safflower, and peanut oil are interchangeable with soybean oil in the manufacture of many edible products. The volume and unit price of the different oils available will be the primary determinants of which oils are most widely used.

Changing food habits and the publicity given to so-called polyunsaturated fatty acids and their relationship to heart disease are among the factors which may have contributed to the striking increase in use of liquid fats in the diets of the American people. This trend will probably continue.

Linseed, tung, castor, palm, and coconut oil and inedible tallow and grease are used primarily in the production of paints and varnishes, resins, plastics, soap, chemicals, plasticizers, and detergents. These fats and oils now are being replaced in some uses by synthetics. As an example, in the past decade use of oils and fats in soaps has been reduced by about one-half owing to synthetic detergents, and the drying oils have lost markets to petrochemical products. Tall oil has displaced appreciable amounts of soybean oil in alkyd resins for paints. On the other hand, a considerable amount of eposidized soybean oil is now produced annually for use in plasticizers; methylated soybean oil foots now find nonfood outlets, and polyamide resins now consume considerable amounts of vegetable oil (17).

The hydrogenation of oils, a process which hardens the oil and removes most of the color and flavor, broadens potential food uses for some oils. Research developments in technology have also made possible wider and more efficient nonfood use of some fats and oils. Further new developments can be expected as a result of continuing technological research.

Geneticists report encouraging progress in developing acceptable cotton varieties that are free of the darkly pigmented seed glands. This would eliminate the glands that contain gossypol--a substance which causes the meal to be toxic to nonruminant animals (20).

The development of a high-capacity saw for delinting cotton could increase capacity and operating efficiency in the cottonseed processing industry. An 18-inch saw, about 50 percent larger than the old saw and rated as having considerably greater capacity, is now in the experimental stage (30).

SUMMARY

Production of U.S. fats and oils more than doubled during the past two decades, and the Nation became a net exporter instead of a net importer. The market also reflected the changes that affected other farm products. The industry underwent changes in organization and structure; processing methods and techniques; size, type, and number of mills processing the various oilseeds; the volume of different fats and oils produced and their disposition and utilization in domestic and foreign outlets, particularly following World War II.

This country's change from a net importing to a net exporting country was emphatic. By the midsixties, U.S. production accounted for more than one-fourth of the world's total supply of fats and oils. Before World War II, it was about 5 percent of the total.

In contrast to the increase in production, per capita consumption of fats and oils in the United States changed little, remaining at about 70 pounds during the past several decades.

Important technological developments have occurred in the fats and oils industries during the past 20 years or so. The shift in the oilseed crushing industry from the hydraulic method of extracting to the more efficient screw-press, solvent, and prepress-solvent methods was one of the more significant developments. It was a major factor in the trend toward fewer but larger mills, and in the increase in oil yields per unit of raw material processed. The hydrogenation of fats and oils was also an important technological achievement, making possible a wider use of some oils.

Soybean oil and cottonseed oil are the two major vegetable oils produced in the United States, accounting for about 90 percent of total production. Both are used primarily in the production of edible commodities. Until the early fifties, cottonseed was the major source of the domestic supply of vegetable oil. However, by the midsixties, soybeans contributed two-thirds or more of the domestic supply of vegetable oils.

Flaxseed is the major industrial oilbearing crop produced in the United States. Linseed oil, produced from flaxseed, is an important industrial drying oil; however, its consumption in recent years has trended downward. Other important sources of vegetable oils are safflower, olives, peanuts, sesame, corn, castor beans, and tung nuts. Although the contribution of these oils to the total U.S. supply is relatively small, many of them are as good and, in some instances, better than soybean and cottonseed oils for specific uses.

Animal fats such as butter, lard, edible and inedible tallow and grease, and marine oils are other major sources of fats and oils in the United States. They accounted for about 46 percent of the total production of fats and oils in the mid-sixties. Both total production and consumption per person of the individual animal fats have trended downward in recent years, except for inedible tallow and grease, which increased. Most of the total supply is used domestically. Animal fats and oils may be substituted for vegetable oils in the manufacture of many end products, so, their impact on the development of the vegetable oilseed industry, and trends in their production and consumption, were considered in the analysis.

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